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Sent: 10/2/2012 11:50:46 AM
To: Bob Sussman/DC/USEPA/US@EPA
CC: James O'Hara/DC/USEPA/US@EPA; Alisha Johnson/DC/USEPA/US@EPA
Subject: FYI: Media coverage coming out of Dimock, PA

- "Cabot's Methodology Links Tainted Water Wells to Gas Fracking," *Businessweek*, October 2, 2012
- "Cabot beat EPA to punch on well's water," *Scranton Times-Tribune*, October 1, 2012
- "Water samples suggest Dimock's methane problem hasn't dried up," *Scranton Times Tribune*, October 1, 2012

"Cabot's Methodology Links Tainted Water Wells to Gas Fracking," *Businessweek*, October 2, 2012

By Mark Drajem and Jim Efstathiou Jr. on October 02, 2012

Methane in two Pennsylvania water wells has a chemical fingerprint that links it to natural gas produced by hydraulic fracturing, evidence that such drilling can pollute drinking water.

The data, collected by the U.S. Environmental Protection Agency, are significant because the composition of the gas --its isotopic signature -- falls into a range Cabot Oil & Gas Corp. (COG) had identified as that of the Marcellus Shale, which it tapped through hydraulic fracturing, or fracking.

"The EPA data falls squarely in the Marcellus space" established by Cabot's scientists, said Rob Jackson, an environmental scientist at Duke University. That evidence backs up his findings linking gas drilling and water problems in the town of Dimock, applying the very methodology that Cabot established to try to debunk it, he said.

Cabot maintains that its operations haven't contaminated homeowners' wells, and its scientists say further analysis shows this gas isn't from the Marcellus, a mile-deep formation running from New York to the southwestern tip of Virginia. Industry groups say there hasn't been proof of fracking contaminating water anywhere, and dispute research that suggests pumping millions of gallons of water, sand and chemicals underground to break apart rock and free trapped gas endangers the environment.

The question of the provenance of the gas in the northeastern Pennsylvania town has taken on national importance after tainted wells there were featured in the film "Gasland." Last year, the EPA stepped in to test the water, one of only a few cases nationwide where the federal agency intervened in a dispute over fracking and water woes.

High Profile

"Dimock is so important because it's so high profile," Kate Sinding, a senior attorney at the Natural Resources Defense Council in New York, said in an interview. "It's been a poster child for what can happen with fracking."

In a 2010 consent order, the Pennsylvania Department of Environmental Protection found that 18 drinking-water wells in the area were "affected" by Cabot's drilling. The company disagreed, and applauded when the EPA cleared the water in Dimock as safe this July. State regulators ruled last month that Cabot could begin fracking seven wells in the affected area of Dimock, ending a moratorium imposed in 2010.

The latest data, which the EPA began to collect early this year, were posted on the agency's website in response to Freedom of Information Act requests from Jackson, Cabot and others. The EPA submitted the results to its researchers conducting a broader nationwide study about the effects of fracking on drinking water, agency spokesman David Bloomgren said.

Gas Production

Gas production in Pennsylvania shot up over the past few years as companies expanded their use of fracking. The Marcellus Shale is about 5,000 feet underground in Pennsylvania, separated by thick rock layers from water aquifers, which are at most a few hundred feet down.

Still, the surge in fracking has been accompanied by a spurt in complaints from homeowners who say their water has been contaminated, resulting in sick children, dead livestock and flammable tap water.

In Dimock, the EPA found that some residents had methane in their water at or more than 14 milligrams per liter -- double the Pennsylvania state safety level -- even as it issued a statement that the water was safe to drink. The U.S. doesn't set a limit on the gas's level, as the agency says methane doesn't impair the smell or taste of water. It can be explosive.

Methane Amounts

Jackson was part of a four-person team from Durham, North Carolina-based Duke that first published research in the Proceedings of the National Academy of Sciences last year that said water wells found closer to gas drilling had greater amounts of methane. The isotopic characteristics of some of the gas in those wells were consistent with that of the Marcellus, they concluded.

Jackson's lab received \$50,000 from the Park Foundation, which has funded groups critical of oil and gas drilling, to conduct baseline testing of water in New York, which is considering lifting a de facto ban on fracking. That funding came after the initial Dimock research was completed, he said.

Cabot took issue with the Duke findings.

In a paper its scientists co-published with Lisa Molofsky, an environmental geologist at GSI Environmental Inc., an environmental-engineering consulting firm in Houston, they concluded that pre-drilling data from more than 1,700 water wells in Pennsylvania showed methane was naturally "ubiquitous in shallow groundwater."

Isotopic Characteristics

They identified the isotopic characteristics that would differentiate Marcellus Shale gas from other so-called thermogenic gases, which are fossil fuels formed by pressure and heat underground, and concluded that the water wells in Dimock didn't have gas from the Marcellus, but from a shallower layer, the Middle and Upper Devonian.

"The assertion by the Duke study that hydraulic fracturing of the Marcellus Shale is contributing thermogenic methane to local water wells and shallow regional groundwater is unsubstantiated given the lines of evidence," Molofsky and her co-authors concluded in the December paper published in Oil & Gas Journal.

To reach that finding, Molofsky established a range of isotopic values, or the ratio of heavier to lighter carbon, and heavier to lighter hydrogen molecules in the gas, which the researchers wrote provide "valuable geochemical fingerprinting tools."

In the recently published EPA samples from Dimock, two households had methane that fell within that range. Three others had values nearby.

Results Disputed

Neither Cabot nor Molofsky is convinced.

Molofsky said that the structure of the molecules shows evidence of oxidation, which could allow a shallower-origin gas to appear to be from the Marcellus. She has now moved to analyze the isotopic signatures of the methane along with that of ethane, another component of natural gas. That evidence, which hasn't been published yet, shows the gas in homeowner wells is not from the Marcellus formation, she said in an interview.

"The vast array of data that we have analyzed does not show a match for Marcellus Shale gas" in Dimock, Cabot spokesman George Stark said in an interview.

Seeping Gas

If it is Marcellus gas, how did it get in the water wells? Jackson hypothesizes that the steel casings used to keep wells from leaking failed, allowing Marcellus gas to seep out. In the other wells that show evidence of shallower gas, cement lining the wells may not have been installed correctly, providing a pathway for gas to migrate, he said. The results could be an indication of more contamination to follow.

"If it's Marcellus, and a problem with casing or even hydraulic fracturing, is it only a matter of time before other things show up?" Jackson said in an e-mail, referring to the chemicals used in fracking. "That's what I would worry about if I lived there."

Industry geologists counter that even if it's Marcellus gas, it could have arrived in the aquifer via natural channels and not because of drilling.

"This doesn't tell us anything about the travel time," John Conrad, a hydrogeologist at Conrad Geoscience Corp. in Poughkeepsie, New York, said in an interview. "More likely than not" the gas migrated "over millions of years."

Pennsylvania Scientist

Fred Baldassare was a hydro-geologist at the Pennsylvania Department of Environmental Protection who analyzed the isotopes of methane in Dimock when the state began investigating homeowners' complaints in 2009.

He is neither convinced by the new EPA data, which he said is too limited to make a conclusion, nor the denials by Cabot. The methane the EPA sampled could have changed over time, and without earlier results from those same wells, they aren't conclusive, he said.

Still, he said, earlier evidence that he analyzed was conclusive.

"The molecular and isotopic evidence I saw was that the gas in the water supply looked like the gas in the Cabot gas wells," Baldassare, who now runs his own water testing firm called Echelon Applied Geoscience Consulting in Murrysville, Pennsylvania, said in an interview.

"It's doing more damage than good to keep denying" that connection, he said: "Let's get past that."

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"Cabot beat EPA to punch on well's water," *Scranton Times-Tribune*, October 1, 2012

By Laura Legere (Staff Writer)

Of the 62 water wells the U.S. Environmental Protection Agency sampled in Dimock Township, one spurred the agency to take immediate action.

Test results from the well, which contained nine times the safe drinking water limit for arsenic, were flagged by regional EPA officials who quickly received approval from the agency's Washington, D.C., headquarters to provide the home with emergency replacement drinking water, emails between agency officials show.

The regulators drafted a plan to share the news with the resident, who has not been named. If she accepted the offered water, it would trigger a detailed chain of action to alert state regulators, elected officials, natural gas driller Cabot Oil and Gas Corp. and the press.

But when EPA officials visited the resident to tell her about the arsenic hazard on Feb. 17, they learned that state regulators had told her about the results two days earlier and Cabot began providing her with bottled water the day before.

At the resident's request, federal toxicologists returned to her home on March 1 to discuss health risks associated with arsenic exposure, but she told regulators she was happy with Cabot's delivered drinking water, an EPA spokeswoman later said.

The extent of the agency's effort - and the fact that Cabot provided the resident with water - was not disclosed in the EPA's statement in April when the agency publicly released the round of test results that included the arsenic finding.

At the time, the agency said only that "at one well, EPA found elevated levels of arsenic and offered alternate water but the resident declined."

Federal regulators did not try to determine the source of the arsenic. In a January memo outlining the agency's justification for investigating water quality in Dimock, the EPA described arsenic as a known human carcinogen and a "naturally occurring element widely distributed in the earth's crust" that "may also be present at elevated concentrations in the groundwater due to the use and effects of drilling fluids."

The resident also declined the state's offers of assistance, Pennsylvania Department of Environmental Protection spokesman Kevin Sunday said.

"Arsenic is naturally occurring and is not used in the completion process," a term for hydraulic fracturing of natural gas wells, he said.

When the EPA concluded its investigation in July, it released a statement saying that in all cases where it found substances that might cause a health concern in Dimock drinking water "the residents have now or will have their own treatment systems that can reduce concentrations of those

hazardous substances to acceptable levels at the tap."

An EPA spokeswoman at the time described the treatment systems as "pre-existing treatment systems owned by the homeowner."

But for the home with high arsenic, the treatment system was provided by Cabot, a company spokesman confirmed.

"EPA, PADEP, and the homeowner do not believe Cabot is responsible for the arsenic levels," Cabot spokesman George Stark said. "Nonetheless, based on our commitment to working with the Dimock community and experience with water filtration systems, we identified and provided the homeowner with a treatment system that is removing arsenic down to non-detect levels."

"Water samples suggest Dimock's methane problem hasn't dried up," *Scranton Times Tribune*, October 1, 2012

More than two years after the state halted a natural gas driller's operations in a corner of Dimock Township, the right answer to a last question is all that stands between drill bits and earth.

Are leaking wells still allowing gas to escape into residents' drinking water?

Water samples taken during a recent federal investigation in the Susquehanna County village suggest that methane problems persist.

The U.S. Environmental Protection Agency ended its investigation of potential water contamination from natural gas drilling in July, yet it has publicly synthesized very little of the over 100,000 pages of information it gained during six months of sampling and data-gathering in Dimock.

In official statements, the agency said it set out only to determine whether the water in Dimock is safe to drink and found that in most cases it is or can be treated to safe levels.

But emails released to Times-Shamrock newspapers and sampling results posted online show that an early focus of the EPA's interest in Dimock - the continued cause of high levels of gas in private water wells and the options for removing it - was largely dropped from the investigation the agency ultimately pursued in the township even though the EPA found methane above state review limits in a third of the private water wells it sampled.

The state Department of Environmental Protection has been conducting the main investigation into Dimock methane contamination since 2009, when gas ignited in a water well and blew apart its concrete cover.

Methane is not considered toxic in drinking water but it can create a risk of explosion or asphyxiation if it escapes from water and becomes trapped in confined spaces. Enough methane can also increase concentrations of some metals in drinking water, including manganese, a correlation that was explored by the EPA.

To resume drilling new wells in a 9-square-mile area of Dimock, Cabot Oil and Gas Corp., the operator deemed responsible for the contamination, must prove through regular testing that methane has stopped leaking from its wells or that the methane in the aquifer has returned to background levels.

In late August, the state DEP announced that seven Cabot gas wells that had never been

hydraulically fractured were not to blame for the problems in Dimock, and Cabot could complete the work necessary to produce gas from the wells.

Hydraulic fracturing, or fracking, extracts gas from tight rock by cracking it with chemically treated water and sand under high pressure, and is a separate process from drilling a well.

A settlement the state signed with Cabot nearly two years ago outlines what else the company must do to demonstrate that the methane leaks have stopped: Cabot must screen 18 methane-tainted water supplies until there is less than 7 milligrams per liter of methane dissolved in the water and no airborne gas dangerously trapped in the wells.

The company must also show that for two straight years the dissolved methane in each well is at or below the 7 milligrams per liter threshold in 75 percent of regular water tests. No sample can have more than double that amount of gas.

The state can waive those requirements if it finds that the methane levels in the water now reflect natural conditions unrelated to shale development - a tricky task because no methane samples were taken before drilling began.

DEP has not yet determined that Cabot has satisfied all of the obligations outlined in the settlement, including "demonstrating the gas wells are no longer introducing methane into the aquifer," spokesman Kevin Sunday said.

Gas in the water

Beginning in January, federal regulators tested for methane in Dimock and found it.

In the 59 water wells the EPA analyzed for dissolved methane, 20 had more than the state's threshold of 7 milligrams per liter of the gas in the water, 15 of those had double that amount or higher and five had four times the threshold - the point when the gas begins to escape from the water and create a potential explosion risk if not treated or vented.

Only six of the 20 water supplies with elevated methane apparently had treatment to remove the gas at the time of the testing, because methane levels at the tap were much lower than those recorded close to the well.

A report posted online by the EPA's Dimock site coordinator this month described how sampling was disrupted at one home in January because "explosive levels of gases were detected" in the shed that holds the home's water treatment system and the sampling team was forced to "(open) the door to the shed for ventilation, (apply) a tube to the spigot and (collect) the samples from a distance from the tap."

The prevalence of high methane levels in the sampled Dimock wells - 34 percent - is much greater than the rate documented during baseline water sampling in northeastern and north-central Pennsylvania more broadly.

Pre-drilling water samples taken by another shale operator, Chesapeake Energy, in Bradford, Susquehanna, Wyoming, Sullivan and other regional counties, found methane at or above the state's 7 milligrams per liter threshold in only 3.4 percent of more than 11,000 water wells, according to research presented at an industry conference on Sept. 13.

The state is reviewing the EPA's data as it evaluates whether Cabot's has met its obligations under

the settlement, Sunday said.

Asked whether the EPA tests might show the methane migration in Dimock has affected more homes than previously thought, he said the state has "not drawn any conclusions from the data at this time."

'Exactly like Marcellus methane'

In addition to measuring the amount of methane it found in Dimock water supplies, the EPA performed a type of testing commonly used to determine where the gas came from.

The analysis, a form of chemical fingerprinting, studies stable isotopes in the methane for signs of its origin. It can help distinguish between deep gas harvested by drillers, shallow gas caused by the breakdown of organic material and gas trapped in middle rock layers that can sometimes find natural pathways or travel up flaws in gas wells to drinking water.

The EPA posted the results of its isotopic tests from 12 wells online but the regional EPA office that led the investigation did not attempt to interpret the data because it is "complex and beyond the scope of the efforts in Dimock," agency spokeswoman Terri White said in an email. Instead, the office forwarded the information to a branch of the EPA that is conducting a national study on the effects of hydraulic fracturing on drinking water.

"The results are not helpful in evaluating the actual drinking water quality of the well water - which was the primary goal of the agency's effort in Dimock," she wrote.

State regulators agree that the isotopic data is complex and the gas signatures in the region are "highly variable," Sunday said. The DEP is studying the data as part of its review of Cabot's compliance with the settlement.

Outside scientists that have reviewed the data disagree about whether it can be used to draw conclusions about the methane's origin without past tests to compare it to. Such comparisons are difficult because the EPA stripped identifying information about the water wells to protect the Dimock homeowners' privacy when it released the test results.

Fred Baldassare, the DEP's former stray gas inspector - now in private practice - whose work helped build the state's case that faulty Cabot wells caused methane contamination in Dimock water in 2009, said it would be "inappropriate" and "very shortsighted" to try to interpret the EPA's isotope data without considering previous tests that were likely taken from some of the same wells.

Methane that looks like it originated deep underground might instead be residual gas from a shallower source that has changed over time because the source is no longer discharging methane into the groundwater system, he explained. A signature that has stayed the same, on the other hand, might point to a continuing discharge of methane into aquifers.

But Robert Jackson, an environmental scientist at Duke University who co-authored a 2011 study showing a correlation between gas drilling and methane in Northeastern Pennsylvania water wells, said the "simplest explanation" - methane contamination from deep rocks - is the likeliest. The signatures of the methane and ethane gathered by the EPA show evidence of two kinds of contamination related to natural gas drilling, he said: gas that moves from middle rock formations through imperfections in the cement between steel casings in the wells and deeper gas that leaks out through poor casings.

In between three and five of the samples posted by the EPA "the methane in the water looks exactly like Marcellus methane" in Susquehanna County and ethane signatures appear to confirm that

conclusion, he said.

"I don't think there's a natural pathway for this," he said and argued that the new results buttress Duke's earlier findings.

"There are people who say there is nothing going on in Dimock and I think that's wrong, based on the evidence."

Cabot says that its wells are not leaking methane into Dimock aquifers, and they never were.

Where methane levels have not declined enough to meet the standards outlined in the state settlement, Cabot is building a case that the methane levels reflect natural conditions.

Cabot employees co-authored a December 2011 study that found detectable levels of naturally occurring methane in nearly 80 percent of water wells it sampled before drilling nearby in Susquehanna County, where drinking water is frequently drawn from rock layers charged with gas.

The study found higher levels of methane correspond to water wells drilled in valleys and have no relation to proximity to gas wells. (The authors described the range of detectable methane as less than .0001 milligrams per liter to greater than 10 milligrams per liter, but did not report how frequently Cabot found methane levels above the state threshold in water before drilling.)

A Cabot spokesman said the company's review of the methane isotope data does not show a match to the Marcellus Shale.

In a prepared statement, spokesman George Stark said, "After the EPA investigated claims and tested, and retested, water samples, the agency announced on July 25 that it would cease deliveries to residents currently receiving water because the agency 'determined that it is no longer necessary to provide residents with alternative water.'

"The EPA released data that once again confirmed the agency's and DEP's findings that levels of contaminants found do not pose a threat to human health and the environment."

'A large number of wells with problems'

When EPA scientists first responded to Dimock residents worried about the safety of their drinking water late last year, methane contamination was seen as a central sign of the problems in Dimock.

Two months before the EPA officially declared its intention to sample water supplies in Dimock, two EPA officials wrote to the state's head oil and gas regulator, Scott Perry, to raise concerns about levels of gas and other contaminants in private Dimock wells that might be linked to Cabot's drilling.

The messages, released to Times-Shamrock newspapers in response to a Freedom of Information Act request, outline the possibility of a much broader federal action than the one eventually taken by the EPA in the town.

The federal regulators, Karen D. Johnson and Jon Capacasa, questioned the effectiveness of Cabot-installed treatment systems in removing metals, organic chemicals, radionuclides and gases that periodically showed up in tests of private water wells in Dimock. They raised concerns about the long-term reliability and maintenance of the treatment systems, and described the difficulty of verifying if Cabot's efforts to plug or patch suspected faulty gas wells had stopped the flow of methane into shallow aquifers.

"It is clear from the volumes of data that DEP has collected, and Cabot in the Dimock area, that there

are ground water effects on the private wells, and that in some cases the treatment systems installed at least by Cabot in Dimock, are not capable of removing all the contaminants," Johnson wrote.

"I'm particularly concerned that several of the homes with treatment have the highest levels of propane, ethane and ethene, after treatment," she continued, referring to other combustible gases that sometimes coexist with methane. "It may be that the samples were during a 'shake down period' on the treatment, but in talking to the residents that are using the treatment systems, they really don't have any confidence that they can drink their water."

Johnson and Capacasa proposed that further tests of the structural integrity of Cabot's gas wells or more remediation might be necessary to eliminate the methane problem. They suggested that because high methane levels persist in private water wells "the only means of remedying it" could be to have Cabot drill shallow gas wells to "draw off the pressure" in rock layers above the Marcellus Shale.

Later in the emails, the officials also suggested that the federal agency could invoke its authority under the Safe Drinking Water Act to regulate some of Cabot's wells if allegations that the company used diesel fuel to hydraulically fracture at least two early Dimock wells proved true. A 2005 rule exempted the fracking process from federal regulation as long as diesel is not used.

Johnson wrote that federal authority could give regulators tools to confirm if the gas wells are structurally sound.

"They certainly had a large number of wells with problems," she said.

The agency did not take that route. A lawyer for the regional EPA office said the agency never asked Cabot if it used diesel in its wells because the EPA was still working at the time to define what it meant by "diesel" as it developed regulations for wells fracked with the fuel. A Cabot spokesman did not respond to a question about the allegations of diesel use.

Instead, the agency said in January that "the presence of hazardous substances" in drinking water compelled it to act under the Superfund law to deliver fresh water to four homes and conduct sampling at 64.

In the end, the EPA did not evaluate the effectiveness of any methane treatment systems, try to determine the source of methane or any other contaminant in Dimock drinking water wells, or require any remediation actions from Cabot, said White, the agency spokeswoman.

As it reviewed sample results from Dimock, the EPA notified residents, the state and the county emergency management agency whenever it found that a well had enough gas in it to pose a potential explosion risk.

The EPA's goal "was to provide the Dimock community with reliable information about the presence of contaminants in their drinking water and determine whether further action by EPA was warranted to protect public health," she said. The emails sent by agency officials to the state prior to the investigation are "indicative of routine communications" the agency has with the state to offer "technical advice."

"We recognize that PADEP has jurisdiction over private wells and oil and gas operations including the situation in Dimock," she said.

State investigation

DEP spokesman Kevin Sunday said the settlement the state reached with Cabot already addressed

the EPA officials' concerns about the company's obligations to restore private water wells it disrupted.

Money Cabot paid into escrow accounts was meant to allow residents to buy and maintain treatment systems or replacement water, he said. The company also had to offer to install methane-removal systems on 18 affected water wells, but the settlement does not explicitly require Cabot to inspect or maintain the systems at the homes that took them.

Stark, the Cabot spokesman, defended the treatment systems by saying that "all were approved by DEP."

The DEP also rejected the EPA officials' suggestion of drilling shallow wells to get rid of the gas in Dimock's aquifers.

"Relief wells treat only a symptom and do not eliminate the source of the methane," Sunday said.

Since December 2010, the DEP has been evaluating Cabot's efforts to comply with the settlement and enforcement order that will allow it to resume full operations.

The thoroughness of the DEP investigation in Dimock is one reason state regulators bristled when the EPA began its own investigation in the town. The state has required Cabot to submit details about pressure built up in its wells, efforts to patch potential leaks, water samples collected before and after drilling in Susquehanna County, and characteristics of the gas the company found in the water.

The state received a list of 33 homes where Cabot at some point delivered replacement water to homeowners who were concerned that drilling had affected their wells, then regulators went to the homes and tested the water.

In its review, the state found a new case of methane leakage: regulators blamed at least one of four gas wells Cabot drilled on the Shields property in Springville Township - west of the off-limits area - for more than tripling methane levels in one water well to 84 milligrams per liter after Cabot began drilling. The violation notice is not recorded in either of the DEP's public oil and gas compliance databases online, but it was provided to Times-Shamrock newspapers in response to an open records request.

Whether and when Cabot is allowed to drill new wells in the off-limits section of Dimock rests with the state.

On the same day DEP granted Cabot permission to frack but not drill new natural gas wells in the area, Perry, the department's deputy secretary for oil and gas management, wrote back to a township resident who asked in late July, "Exactly what is the hold up?"

"Simply put," he wrote, "more data needs to be evaluated."